C. Ionization energy

1. It is a measure of _____

_____

2. The smaller the ionization energy is, the easier the electron is to remove.

3. As we go across the periodic table from left to right, the distance between nucleus and the electrons decreases, the electrons become more tightly bou and the ionization energy increases. As we move down a group, the electr are separated from the nucleus by more layers. Consequently, the nucl exerts less attraction on the electrons, and it becomes easier to pull out electron. So ionization energy gets smaller.

D. Electronegativity

1. It is a measure of _____

_____

2. The greater the electronegativity, the greater affinity the atom has for electr

3. Electronegativity _____ as one moves from left to right in periodic table.

4. Electronegativity _____ as one moves down a group in periodic table.

SELF-TEST

A. Multiple Choice:

1. How many unpaired electrons are there in an atom with the electron configurati

$$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6$$

a. 1 **b.** 2 **c.** 3 **d.** 4 **e.** some other numb

2. Which one of the following represents a possible *excited* electron configuration which an electron has been promoted from the ground state to a higher level?

a. $1s^2\ 2s^2\ 2p^6\ 3s^2$ **b.** $1s^2\ 2s^2\ 2p^6\ 3s^1\ 3p^1$ **c.** $1s^2\ 2s^2\ 2p^6\ 3s^3$

d. $1s^2\ 2s^2\ 2p^5\ 2d^1\ 3p^2$ **e.** $1s^2\ 2s^2\ 2p^7\ 3s^1$

3. Which of the following statements is correct?

a. Atomic radii increase as one moves from left to right across a period.

b. Atomic radii increase as one moves down a group.

c. Negative ions are smaller than the nonmetals from which they are formed.

d. Positive ions are larger than the metals from which they are formed.

the following series of atoms are the first ionization energies decreasing?
a > Ra
> S
b. Li > Be > B
d. As > P > N

ıum number of electrons possible in an f sublevel is
b. 6 **c.** 14 **d.** 32

two very intense lines in the atomic spectrum of sodium. The wavelengths
nm and 589.6 nm. Which line corresponds to the larger energy?
is the same for both lines.
is greater for the 589.0 nm line.
is greater for the 589.6 nm line.
t answer because insufficient information is given.

y elements in the second period of the periodic table (starting with Li) have
ore unpaired electrons?
b. 4 **c.** 5 **d.** 6 **e.** 7

sublevel and a half-filled f sublevel contain a *total* of how many electrons?
b. 17 **c.** 19 **d.** 24

e following orbital diagram

1s	2s	2p	
(↑)	(↑)	( )( )( )	= hydrogen atom – excited state
(↑↓)	( )	( )( )( )	= hydrogen atom – ground state
(↑↓)	( )	( )( )( )	= helium atom – ground state
(↑)	(↑)	( )( )( )	= helium atom – excited state

ıe number of correct orbital diagrams is
b. 1 **c.** 2 **d.** 3 **e.** 4

lius of
$Br^- > Br$ **(2)** Li < Na **(3)** Mg > Cs **(4)** $K^+ > Cs^+$

e statements above are
2) **b.** (1),(3) **c.** (2),(3) **d.** (2),(4) **e.** (3),(4)

B. True or False

_____ **1.** The energy required to make the transition from n = 1 to n = 3 is twice the energy required to make the transition from n = 1 to n = 2.

_____ **2.** A 3p subshell can have an electron with quantum number $\ell = 2$.

_____ **3.** An important factor in determining the relative size of halogen atoms in their ground state is the principal quantum number.

_____ **4.** The first two quantum numbers (n, ℓ) of the highest energy electron in the ground state of Sc^{3+} are 3,1.

_____ **5.** The electron configuration $1s^2\ 2s^2\ 2p^4\ 2d^1$ may be that of fluorine in an excited state.

_____ **6.** Pauli's exclusion principle states that two electrons in the same orbital have the same spin.

_____ **7.** It is possible for an electron to have $4,0,1,\frac{1}{2}$ as its set of 4 quantum numbers.

_____ **8.** The ionic radius of Na^+ is larger than the atomic radius of Na.

C. Fill in the Blanks

_____ **1.** How many electrons with quantum number $\ell = 1$ are there in the ground state electron configuration for potassium?

_____ **2.** How many electrons can have both quantum numbers n = 2 and $\ell = 1$?

_____ **3.** How many unpaired electrons are there for arsenic in its ground state?

_____ **4.** What is the abbreviated ground state electron configuration for Zr^{3+}?

_____ **5.** What neutral element is represented by the electron configuration $1s^2\ 2s^2\ 2p^6\ 3s^1\ 3p^1$?

_____ **6.** Does the electron configuration in #5 represent the element in its ground state?

_____ **7.** What is the symbol of the most electronegative element in Group 15?

_____ **8.** Which neutral element in Period 4 has the largest radius?

_____ **9.** Which neutral element in Group 2 has the largest first ionization energy?

_____ **10.** Write the abbreviated ground state electron configuration for nickel.

D. Answer the questions below, using **LT** (for *less than*), **GT** (for *greater than*), **EQ** (for *equal to*), or **MI** (for *more information required*) in the blanks provided.

_____ **1.** The wavelength of the photon required to promote an electron in the hydrogen atom from the n = 1 to the n = 3 level is (1) the wavelength of the photon required to promote an electron in the hydrogen atom from the n = 1 to the n = 2 level.

_____ **2.** For a scandium atom in the ground state, the energy of the 3d sublevel is (2) the energy of the 4s sublevel.

_____ **3.** The number of unpaired electrons for a carbon atom in the ground state is (3) the number of unpaired electrons for an oxygen atom in the ground state.

_____ **4.** The ℓ quantum number of the 3p sublevel is (4) the ℓ quantum number of the 5p sublevel.

_____ **5.** The atomic radius of the fluorine atom is (5) the atomic radius of the fluoride ion.

_____ **6.** The atomic radius of the magnesium atom is (6) the atomic radius of the chlorine atom.

_____ **7.** The electronegativity of the halogen atom in the second period of the periodic table is (7) the electronegativity of the halogen atom in the fourth period of the periodic table.

_____ **8.** The first ionization energy of potassium is (8) the first ionization energy of calcium.

E. Problems:

Consider the second line of the Paschen series (n = 5 to n = 3) of the hydrogen atom.

1. Calculate ΔE in kJ/mol.

2. Calculate λ.

3. Calculate ν.

Consider technecium (Z = 43).

4. Write its electron configuration.

5. Write its orbital diagram.

6. Write its abbreviated electron configuration.

7. Write the abbreviated electron configuration for Tc^{2+}.

A new element was made and found to have 115 protons and 187 neutrons,

8. Its atomic number is _____.

9. Its outer electron configuration is _____.

10. The element it most resembles in chemical properties is _____.

11. Compare its atomic radius with that of Fr.

12. Compare its ionization energy with that of As.

13. Compare its electronegativity with that of Po.

ANSWERS

Exercises:

(E1) 6.57×10^{11} nm
(E2) 1.82×10^{-7} kJ/mol
(E3) 657 nm
(E4) 2.742×10^{14} s^{-1}
(E5) 0, 1, 2, 3
(E6) 3, 2, 1, 0, -1, -2, -3
(E7) 18; 6
(E8) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^2$
(E9) $[Ar]\ 4s^2\ 3d^{10}\ 4p^4$
(E10) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^6\ 6s^2\ 4f^{14}\ 5d^{10}\ 6p^2$
(E11) (↑↓) (↑↓) (↑↓)(↑↓)(↑↓) (↑↓) (↑↓)(↑↓)(↑↓) (↑↓) (↑↓)(↑↓)(↑)(↑)(↑)
(E12) (↑↓) (↑↓) (↑↓)(↑↓)(↑)
(E13) $[Ar]\ 3d^6$, $[Ar]\ 3d^5$, [Xe]

Self-Test

A. Multiple Choice:

1. e **2.** b **3.** b **4.** a **5.** c
6. b **7.** d **8.** b **9.** c **10.** a

B. True or False:

1. F **2.** F **3.** T **4.** T **5.** F
6. F **7.** F **8.** F

C. Fill in the Blanks:

1. 12 **2.** 6 **3.** 3 **4.** $[Kr]\ 4d^1$ **5.** Mg
6. No **7.** N **8.** K **9.** Be **10.** $[Ar]\ 4s^2\ 3d^8$

D. Less than, Equal to, Greater than:

1. LT **2.** GT **3.** EQ **4.** EQ **5.** LT
6. GT **7.** GT **8.** LT

E. Problems:

1. 93.35 kJ/mol **2.** 1.281×10^3 nm **3.** $2.340 \times 10^{14}\ s^{-1}$

4. $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^5$

5.

(↑↓)	(↑↓)	(↑↓)(↑↓)(↑↓)	(↑↓)	(↑↓)(↑↓)(↑↓)	(↑↓)	(↑↓)(↑↓)(↑↓)(↑↓)(↑↓)
1s	2s	2p	3s	3p	4s	3d

(↑↓)(↑↓)(↑↓)	(↑↓)	(↑)(↑)(↑)(↑)(↑)
4p	5s	4d

6. $[Kr]\ 5s^2\ 4d^5$ **7.** $[Kr]\ 4d^5$ **8.** 115

9. $[Rn]\ 7s^2\ 7p^3$ **10.** Bi **11.** smaller

12. smaller **13.** smaller